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UNIVERSITY OF ALBERTA

Validity of the Differential Ability Scales with an Adult Psychiatric Population

by

Anthony G. Ferrari

(C)

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

IN

EDUCATIONAL PSYCHOLOGY

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

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SUBMITTED BY ANTHONY G. FERRARI
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF EDUCATION
IN EDUCATIONAL PSYCHOLOGY.

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Date: April 17, 1990

ABSTRACT

The purpose of this study was to determine the potential utility of the DAS as an alternative to the WAIS-R with adult psychiatric patients. The scores of twenty-one adult psychiatric patients on the Wechsler Adult Intelligence Scale-Revised (WAIS-R), Raven's Progressive Matrices, Mill Hill Vocabulary Scales, and Differential Ability Scales (DAS) were compared to assess the concurrent validity of the DAS, a new test of cognitive ability. Patients were re-tested on the WAIS-R and DAS approximately 30 days after first testing to assess the relative stability (test-retest reliability) of the two tests.

Results of the study, using correlational analysis of raw scores showed that the DAS has good concurrent validity with the other tests when the total scores and the core scales are compared. Test-retest reliabilities on the DAS were similar to those of the WAIS-R indicating good stability of scores for both tests. It was found that although the total DAS takes more time to administer than the WAIS-R, the DAS core sub-tests are approximately equivalent in administration time. In view of this and the value of some of the DAS special sub-tests, it was suggested that the utilization of the DAS core sub-tests and selected sub-tests might be appropriate. It was concluded that the DAS has potential for use with adult psychiatric patients.

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CHAPTER I

INTRODUCTION

INTRODUCTION TO PROBLEM

In clinical settings, psychometric assessment is utilized extensively. An ongoing survey of the use of tests in different psychological settings - psychiatric hospitals, community mental health centers and clinics, counselling centres, centres for the developmentally disabled and mentally retarded, and veterans administration medical centres - shows thirty tests that are used to some degree or another. Thirteen of these are used over fifty percent of the time (Lubin et al, 1985). In psychiatric settings, referrals for psychometric assessment are made as an aid in diagnosis, to help in therapy planning, to screen for organicity, to assist in assessing deterioration of function, to determine out of hospital placement, to aid in vocational and educational decisions, to help determine competency (to stand trial, to manage own affairs, to be on a voluntary admission) and to determine change as a result of therapy. A high percentage of psychiatric patients go through a psychological assessment.

While rarely done in isolation in clinical settings, intelligence testing is commonly used as a part of the total assessment. A general reason for intelligence testing is to

> assess human potential, not deficit, in each person. In the practice of clinical psychology, each patient or client, with the exception of some court mandated referrals, is seen as a professional challenge within the framework of diagnosis, with rehabilitation or an improvement in the human condition as the end. (Matarazzo, 1985, p. 502).

Intelligence testing can prove useful both to the client and to the professional who is doing the helping. According to the American Psychiatric Association (1987) the diagnosis of mental deficiency requires significantly subaverage intellectual functioning as measured by an individually administered IQ test as well as an impairment of adaptive functioning. The diagnosis of schizophrenia requires a general level of functioning that is lower than that previously achieved and clearly intelligence testing can help here. Dementia of all kinds is characterized by, among other things, a global loss of intellectual functioning. The need for accurate intelligence assessment becomes more clear when one considers that the person's entire life can be affected by the score they obtain on an intelligence test. For example, a person judged incompetent for whatever reason can have their affairs taken over by public trustee. Even the seemingly more innocuous decisions made on the basis of intelligence tests (the type of group home the person is placed in, for example) can have far reaching

consequences.

Gregory (1987) discusses the potential of intelligence tests for having harmful social consequences and suggests the need for competent examiners, the necessity of not using the IQ score in isolation to make important decisions about the individual, and the necessity to do periodic retesting. While Gregory uses an example of a child who was misplaced through the misuse of the Standford-Binet, he goes on to say that adults, whose intellectual capacities are more stable than those of children, require periodic retesting to monitor changes in cognitive capacity and to correct any previous distortions. Following Gregory's argument, it would appear that periodic re-testing of the mentally ill is especially necessary because the possible effects of psychotropic medication, the trauma of admission to hospital, and the changing nature of their particular mental illness makes it likely that their cognitive capacity is not as stable as the non-psychiatrically disturbed adult.

In view of the need for initial intelligence assessment in psychiatric settings, the need to monitor changes in cognitive state, and to correct possible initial error it is clear that in addition to competent examiners valid and reliable measures of intelligence are required.

STATEMENT OF PROBLEM

In clinical settings, intelligence tests are usually individually administered (Anastasi, 1988). By far the most frequently used measure of intelligence in these settings is the individually administered Wechsler Adult Intelligence Scale - Revised (WAIS-R) (Kaufman, 1983). The individually administered Standford-Binet (S-B), the group test the Shipley-Hartford, and the culture reduced Raven's Progressive Matrices along with the Mill Hill Vocabulary Scale are also often administered. For verbally impaired subjects, the Peabody Picture Vocabulary Test-Revised is available.

The Differential Ability Scales (DAS), derived from the British Ability Scales (BAS), is a highly promising test of cognitive ability that is scheduled for release by the Psychological Corporation in 1989. This test is designed to assess the cognitive abilities of children in the 2 1/2 to 17 year age group. At the time of writing, there were no published norms for this test and published reliability and validity data are virtually non-existent. The norming version of the test however was available. Visual inspection of the difficulty of the items as well as the overlap age range of 16-17 years with the WAIS-R indicates that it may be suitable without having a ceiling effect for use with adults. For the ages 8 years through 17 years there are thirteen sub-tests: Recall of Designs, Word

Definitions, Pattern Construction, Quantitative Reasoning, Matrices, Similarities, Recall of Objects - Immediate and Delayed, Basic Number Skills, Picture Recognition, Recall of Digits, Speed of Information Processing, Spelling, and Word Reading. The first six are "core" subtests and the rest special sub-tests. The special sub-tests are related to specific abilities and certainly have the potential for recommendations for remedial learning e.g., spelling, word reading. While a number of the abilities measured are similar to those on the WAIS-R, some are also quite different. In addition, a sub-test Speed of Information Processing appears to cross all abilities measured (Psychological Corporation, 1985).

This study was designed to determine the concurrent validity, and 30 day test-retest reliability of the DAS and WAIS-R with an adult psychiatric population. The research, therefore, should provide additional information on the validity and reliability of the DAS as well as its suitability for an adult psychiatric population. As has been noted, there is a need for accurate assessment of the abilities of psychiatric patients as well as the desirability of frequent retesting. It would be worthwhile see if the DAS could be used as a back up or alternative to the WAIS-R. Should the DAS turn out to be suitable with this population, clinicians will have an alternate method of accurately assessing the patient's abilities. A goal of

psychiatric treatment is to improve the functional and cognitive abilities of patients. It is of practical importance to have an alternate device available to see if this has occurred.

PURPOSE OF STUDY

In summary, the purpose of this study was to determine whether the DAS was a possible alternative to the WAIS-R in a psychiatric setting. The following general questions were answered:

1. Does the DAS have concurrent validity with the Raven's matrices, Mill Hill vocabulary scale, and the WAIS-R?
2. What level of test-retest reliability does the DAS exhibit as evidenced by correlations between repeated administrations of the test 30 days apart?
3. Do psychiatric patients obtain significant differences in their scores on repeated administrations of the DAS and WAIS-R 30 days apart?
4. Are there administrative or other aspects of the DAS that aid in determining its suitability in a psychiatric setting?

CHAPTER II

REVIEW OF THE LITERATURE

This chapter discusses the problem from the aspects of need for reliability and validity, a critique of the forerunner to the Differential Ability Scales - the British Ability Scales and some related validation studies, and the Differential Ability Scales with a related study. The results of the discussion indicates the need for validation of the Differential Ability Scales and show the potential this project has for success as a similar test, the British Ability Scales has a number of studies that confirm its utility.

VALIDITY AND RELIABILITY

Briefly put, "validity refers to what the test measures and how useful it is" (Graham and Lilly, 1984, p. 39). The American Psychological Association (1985) and Brown (1980) in a discussion of standards for test usage both agree that validity is the most important consideration in test evaluation. The American Psychological Association further states that validation of a test involves the accumulation of evidence to support the specific inferences made from test scores. The traditional means of accumulating validity evidence can be categorized into content-related, criterion-related, and construct-related evidence of validity. Ideally, validation includes several types of evidence

spanning all three of the traditional categories. Obtaining validity evidence involves examining the present instrument in the present situation and also the use of the same or similar instruments in similar situations. Because no test is valid for all purposes or in all situations or for all individuals it must be realized that validity is situation specific. Evidence for construct-related validity involves using the theoretical meaning of the test score as a measure of the characteristic of interest. It is recommended that the construct of interest be placed in a conceptual framework which specifies the meaning of the construct and distinguishes it from other constructs. Content related evidence demonstrates the degree to which the items or questions on the test represent some universe or domain of content. Test developers must specify the universe of content the test represents and content-related evidence of validity is often of central concern during test development. Criterion - related evidence (that which will be used in the present study)

> demonstrates that test scores are systematically related to one or more outcome criteria. In this content the criterion is the variable of primary interest, as is determined by the school system, the management of a firm, or clients, for example. The choice of criterion and the measurement procedures used to obtain criterion scores are of central importance.

> Logically, the value of a criterion related study depends on the relevance of the criterion measure being used. (Brown, 1980, p. 11)

Basically, one is asking, how accurately the test scores predict success on the criterion measure. There are two designs that can be used for obtaining this type of evidence. In a predictive study scores are obtained to estimate criterion scores that will be gathered in the future, while a concurrent study obtains prediction and criterion information simultaneously.

> Predictive studies are frequently, but not always, preferable to concurrent studies of selection tests for education or employment, whereas concurrent evidence is usually preferable for achievement tests, tests used for certification, diagnostic clinical tests, or for tests used as measures of a specified construct (Brown, 1980, p. 11)

as fits the proposed utility of the Differential Ability Scales.

The reliability of a test "refers to the consistency of scores obtained by the same person when reexamined with the same test on different occasions, or with different sets of equivalent items, or under other variable examining conditions" (Anastasi, 1988, p. 102). The reliability of the test is related to the accuracy of the scores obtained. Thorndike (1951) states three sources of error that can

influence test scores: the first is concerned with conditions of test administration and occurs whenever test conditions are likely to vary. This can be overcome by rigid adherence to the test manual by the administrator. The second source of error comes from the sampling of items comprising the test and even when parallel forms are carefully constructed it is not possible to obtain completely equivalent forms - for some individuals some items on one form may be easier or more difficult than comparable items on the other. So it is expected that a person's scores will vary somewhat, depending on the form of the test being administered. The third source of error and the one that is the hardest to control are the factors associated with the test taker that can be short term (lapses of attention) or long term (personality changes). So even if the same form is administered, if the testing sessions are separated in time there can be differential changes between test takers that reduces the consistency of measurement and lower reliability.

Brown (1980) points out that these types of errors form the basis for a classification of types of reliability. When we are interested in stability of scores over time (e.g., when career counselling does a persons interests change over time or in psychiatric settings does the IQ remain stable) we require evidence of test-retest reliability or the stability of the scores over time. One

problem of retesting with an identical form of the same test is if the time period is short and/or if there are maximal performance tests, a spurious correlation may result if the test takers remember the items. The use of parallel forms which is sometimes recommended for retesting may eliminate the memory factor but can introduce another possible error source-noncompatibility of items. Regardless of whether the same or a parallel test is used, the procedure is to correlate the scores on the two test administrations and report them in the manual.

When the question is would the person taking the test obtain the same score on two or more samples of items taken from the same domain? (for example, retesting when the results of the first test are in question) the reliability procedure is parallel forms reliability and it is useful in eliminating the memory factor. This procedure often gives the lowest reliability estimates because error due to change over time as well as noncompatibility of forms can occur. A third method of determining reliability occurs when reliability must be estimated from a single test administration. The measure, internal consistency, refers to unspeeded tests and can be used when there is one form of a test used one time e.g., classroom exam or when the question is whether all items on the test measure the same thing (e.g., mathematical reasoning). The usual procedure is to split the test into two equivalent parts, correlate

scores on the parts, then correct the correlations for test length. It is an American Psychological Association requirement that test manuals report reliability coefficients and the procedures used to obtain these coefficients.

THE BRITISH ABILITY SCALES (BAS) - DEVELOPMENT AND CRITIQUE

In the first volume of Test Critiques Childs (1984) discusses and critiques the BAS. In order to understand the forerunner of the DAS and to further comprehend the nature and purpose of the scales, the essential points of the Child's article are presented.

The BAS was originally developed in the late 1970's out of a perceived need in Britain for an individually administered intelligence test that was not Americanized. It is a battery of individually administered tests of mental ability for subjects aged 2 1/2 to 17 years. The manual carefully explains interpretation of differences between the scales and combinations of scales can be used to provide measures of overall ability such as verbal IQ, visual IQ, general IQ. A rapid "short form" IQ can also be calculated from scores on only four scales. Childs considers one of the most valuable aspects of this test to be the caution provided in the manual about encouraging these overall measures, especially when discrepancies between scores on the individual scores is large. Besides providing general

IQ's and specific IQ's, the test has the advantage of flexibility in that the scales can be administered in almost any order so that hypotheses about an individual's strengths and weaknesses can be followed up. Differences between scales can easily be evaluated for classification or for diagnostic interpretation. The main intent of the test is to:

(i) evaluate the extent of the problem.

(ii) consider whether intervention is best achieved within the normal classroom or whether more intensive or specialist intervention is required.

(iii) identify possible causes of educational delay.

(iv) to identify strengths that could be used to overcome certain learning difficulties.

(v) to identify weaknesses that may need support prior to curriculum intervention. (Childs, 1984, p. 139).

Childs points out that the above criteria are typical of achievement tests, however, the breadth and flexibility of the BAS make it more useful in performing these functions effectively. The test requires administration by a qualified examiner. In further evaluating the BAS, Childs says that better validity data is required in particular the relationship of individual scales to conceptually similar

scales is not described. He concludes by stating "In this reviewers opinion, the BAS is the best available battery for the psychometric evaluation of mental ability. It is a better constructed and more sophisticated instrument than any of its rivals, its weaknesses should be viewed in that light" (p. 163).

STUDIES UTILIZING THE BAS

There are a number of studies in the literature that investigate the general utility of the BAS as well as its reliability and validity. Some of these are now reviewed to give a better idea of the nature of this test and because of the dearth of studies on the Americanized version, the Differential Ability Scales (DAS). It seems reasonable that the DAS would have similar properties to the BAS and that similar types of investigation are needed.

Cook (1988) compared the scores of 20 Canadian children on the BAS with their results on the Wechsler Intelligence Scale for Children-Revised (WISC-R) and the Wide Range Achievement Test-Revised (WRAT-R) and obtained high correlations for general ability measures and Verbal IQ. Low correlations were found between other scales and the Visual IQ of the BAS and the author suggests than when using the BAS in North American scores should be adjusted upwards by 3 or 4 points. Cumming and Marsh (1985) utilized the BAS, the WISC-R, and the Stanford-Binet (4th ed) (SB-4)with a group of New Zealand children and discovered that the BAS

consistently underrated the subjects ability level when compared with the other two tests. While these authors do not recommend the addition of points when using the BAS in New Zealand, it would seem that there is a social or cultural bias (most likely due to item content) when using the test outside of Britain. The development of the DAS and the utilization of North American norms will offset this problem in North America. McCallum and Karnes (1987) used the same three tests as Cumming and Marsh with a group of gifted children in Great Britian. These researchers discovered that WISC-R Full Scale IQ mean was significantly higher than the means for the BAS and SB-4 composite scores while the BAS and SB-4 were more related to each other. The authors suggest that the high degree of similarity between the tests, especially the BAS and SB-4 composite scores indicates that similar constructs are being assessed to a similar extent across two different cultures.

Finally, Cockburn and Dunstead (1983) used thirteen sub-tests of the BAS and contrasted the intellectual status of 206 children whose mothers had been hypertensive in pregnancy with an age match sample of children of mothers who had not been hypertensive during pregnancy. The control group was found to have significantly higher scores on Immediate Visual Recall, Block Design power, Basic Arithmetic, and Copying.

Ward and Outhred (1986) used four of the core BAS subtests (Matrices, Similarities, Recall of Digits, and Speed of Information Processing) and compared the scores of 208 Australian school children with those of the British standardization group and found the scores on these groups to be similar. Thus, the possible bias does not present itself with these four sub-tests and with this group. Buckhalt and Jensen (1989) investigated the Speed of Information Processing (SOIP) sub-test of the BAS (this sub-test is essentially the same on the DAS) by administering the SOIP, the short form of the BAS, and a series of electronically timed reaction times (RT) to 142 American sixth graders. Analysis of results indicated convergent and discriminant validity for this sub-test and the authors also conclude that SOIP is related more to speed of apprehension than to speed of motor response of movement time.

Not all validity studies on the BAS are confirmatory. Margrain (1985) examined the scales of the BAS and found some scales that contain a high level of test and item bias that undermine the validity of the test, especially for girls. Margrain claims that there is a sexist orientation to many of the tests, particularly the Formal Operational Thinking and the Social Reasoning scales, to the extent they perpetuate the historical and social devaluation of girls and woman, foster prejudice and male aggression against women, and undermine social and sexual equality. Although

Formal Operational Thinking and Social Reasoning are not on the DAS, a challenge like to the BAS validity is one that may also need to be investigated when considering the validity of the DAS.

Two factor-analytic studies, the traditional method of determining construct validity of achievement tests, that address the issue of the specificity of the BAS are now discussed.

The first of these, conducted by Wallbrown et al., (1984) studied three age groups (5-7, 8-13, 14-17) included in the standardization sample and found a general factor and five primary factors at each age level. Three primary factors were evident at all age levels: Verbal Ability, Spatial-perceptual Ability, and Visual Recall while a naming factor was obtained at the youngest age level and a perceptual speed factor was found for the older two groups. Short term memory was also obtained for the oldest group while an achievement factor was evident for the younger two groups. As a result of their analysis, the authors suggest that greater confidence in the specific interpretation of the individual scales than for other test batteries is warranted. Elliot (1986) confirmed the above finding. Using the BAS age groups and a total of 1881 British school children in a factor analytic study, he concluded that the BAS has greater specificity than the Wechsler Preschool and Primary Scale of Intelligence (WPPSI), Wechsler Intelligence

Scale for Children-Revised (WISC-R), and the Wechsler Adult Intelligence Scale (WAIS) and that the BAS has sufficient specificity to justify comparisons between scales.

The BAS have been used to investigate dyslexia and reading disability. Thomson (1982) studied children from the same three age groups as Wallbrown et at who had specific reading disabilities. They found that the subjects did significantly less well on Speed of Information Processing, Immediate and Delayed Visual Recall, Recall of Digits, Basic Arithmetic and Word Reading across all age ranges when compared with other abilities. When various forms of IQ are computed, it is suggested that the four abilities recommended (Word Definitions, Pattern Construction, Similarities, Quantitative Reasoning) for use in computing IQ's in the current BAS manual are inappropriate for use with the dyslexic child. Elliot and Tyler (1986) demonstrated a difference between poor readers and dyslexics in terms of their ability profiles and utilized this information to suggest that a more specific definition of reading sub-types is necessary. The same authors (1987) utilizing the BAS showed that children with learning disabilities in general have verbal deficits and show significantly higher performance on nonverbal tasks and that this tendency is more pronounced in males than in females. McKay and Neale (1987) replicated the above study with a group of Australian children. Finally, Tyler and

Elliot (1988) used the BAS with children who have reading difficulties to conclude that children with specific reading retardation, and dyslexic children in particular, are not homogeneous in their cognitive profiles. The research on the BAS and reading disabilities provides evidence of the application of this type of test. Reading disabilities are not unique to children and this aspect of the BAS has the potential to be extended to adults and especially psychiatrically disturbed adults, providing another reason for validating the test in this population.

THE DIFFERENTIAL ABILITY SCALES (DAS) AND A RELATED STUDY

As has already been stated, the DAS is the American version of the BAS. According to the DAS norming manual, it is like the BAS in that it is a measure of cognitive ability for children. The test developers attempted to keep as much of the original material as they could. Obviously British items were dropped and an attempt was made to strengthen the reliability by adding new items. Six of the original scales (among them Formal Operational Thinking and Social Reasoning) have been dropped and four scales added - Quantitative Reasoning, Picture Similarities, Block Building, and Spelling. The test and manual are new and very much in the developmental stage. Published studies on the DAS are virtually non-existent although it is probable that there is much ongoing research into this test. Lillis (1987) in an unpublished Master's thesis compared thirteen

of the DAS scales, utilizing raw scores only with the Matrix Analogies and Draw a Person and obtained quite high correlations. In view of the lack of research into this test, its obvious promise, and the validation requirements set out by the American Psychologists Association the present study seems warranted.

CHAPTER III

METHOD

SUBJECTS

The subjects were 21 adult psychiatric patients who at the time of initial assessment were being treated as inpatients at the Alberta Hospital Edmonton (AHE). Alberta Hospital Edmonton is a 648 bed regional active treatment centre for the mentally ill. It is the largest psychiatric centre in the Province, and offers clinical programs in acute care, forensic, rehabilitation, and psychogeriatrics.

At Alberta Hospital Edmonton the admission units are designed for acutely disturbed patients whose length of stay is anticipated to be no more than 30 days, forensic units are for people who have drawn the attention of the legal system and also require psychiatric help, while the rehabilitation service is designed for chronic patients in need of long term care (often a number of years). There were 10 males and 11 females in the sample and their ages ranged from 19 years to 67 years with a mean age of 36.4 years. Thirteen of these patients were being treated on one of the Admissions units, three were on one of the Forensic units, while the other five were on the Rehabilitation service. Subjects had varying psychiatric diagnoses and eleven of them were on various psychotropic medications: major tranquilizers, minor tranquilizers, anti-depressants, anti-convulsant, and anti-cholinergic. Education levels

varied from low of six years to a high of a completed Bachelor of Education degree. Occupationally, nine were unemployed (in fact, had never worked), two were retired, while the other ten were employed in occupations of various status. The mean WAIS-R IQ of the group on initial testing was 85.1 with a range from 60 to 130. Table 1 provides a more detailed description of each of the subjects.

TABLE 1
Description of Subjects

Pat. No.	Age	Sex	Education (yrs.)	Occupation	Hosp. Ser.[1]	Diagnosis	Meds[2]	WAIS-R IQ Initial
1	25	M	12	Unemployed	A	Schizo.	MaT	80
2	31	M	10	Unemployed	A	Epilepsy, Depression	AC	95
3	19	M	10	Unemployed	A	Drug Addict. Pers. Dis.	Nil	74
4	26	F	6	Unemployed	R	Epilepsy Per. Dis.	MaT Ach	60
5	62	M	12	Retired Teacher	R	Korsakoff's	MaT	75
6	35	F	9	Secretary	A	Depression	MaT	89
7	47	F	12+	Bank Clerk	A	Depression	AD	80
8	27	F	12	Unemployed	R	Schizo.	MaT	74
9	67	M	8	Retired Truck Driver	A	Korsakoff's	Nil	81
10	41	M	10	Carpenter	F	Pedophilia	Nil	91
11	21	F	10	Unemployed	A	Drug Addict. Per. Dis.	Nil	81
12	34	M	12+	Mechanic	F	Depression	AD	107
13	38	M	9	Baker	F	Pedophilia	Nil	93
14	30	F	10	Sales Clerk	A	Per. Dis.	Nil	93
15	49	F	6	Unemployed	R	Per. Dis.	Nil	74
16	30	F	12	Secretary	R	Anor. Nerv.	Nil	82
17	29	M	12	Unemployed	A	Chron. Anx.	MiT	83
18	47	F	12+	Teacher	A	Depression	AD	130
19	39	F	12+	Unemployed	A	Depression	AD	80
20	41	F	10	Unemployed	A	Depression	Nil	83
21	26	M	12+	Orderly	A	Depression	Nil	97

$\bar{X}$ = 85.1

[1] Hosp. Ser. = Hospital Services
Admissions = A
Rehabilitation = R
Forensic = F

[2] Meds = Medications: MaT = major tranquilizers
MiT = minor tranquilizers
AD = anti-depressants
AC = anti-convulsant
Ach = anti-cholinergic

MATERIALS

The materials used for this study were the Wechsler Adult Intelligence Scale-Revised (WAIS-R), the Ravens Standard Progressive Matrices (RSPM), the Mill-Hill Vocabulary Scale (MHVS), and the test whose utility is being investigated, the Differential Ability Scales (DAS). These devices are all considered to be measures of cognitive ability.

As it was felt that with an adult population the subtests at the lower age bands of the DAS (ages 2 years 6 months through 7 years 11 months) would not be appropriate, only the subtests for the upper age bands requiring the use of the record form C of the DAS were selected. The specific subtests administered were the core subtests:

Recall of Designs - a number of line figures are presented to the subjects. After seeing these for five seconds, the person is required to reproduce them from memory. There are twenty-five figures in all and three teaching items. A teaching item for all sub-tests is one on which acknowledgement of the correct response is permitted. In the upper range only the last twelve are administered and the test is discontinued after six consecutive failures. The manual provides no guidelines for scoring. This test is considered to measure short term recall ability.

Word Definitions - Subject must define words presented in a 'Tell me what is _____?' or ' What's _____' format. If the response is close but not quite correct the examiner may probe for the correct answer. There are fifty three items in all only the last twenty-eight being administered in the upper range. Discontinuation criteria is six consecutive failures and items are scored one or zero even if there was a probe. This test is a measure of vocabulary.

Pattern Construction - Subject constructs a design that is presented by putting together cubes that have black and yellow patterns on each side. There are thirty-six items with the upper age range starting at item twenty one and having two teaching items. There is a time limit for each item however scoring is done in two ways - whether the item is completed within the time limit and whether the item is completed at all,even if over the time limit. Scoring is one or zero and the discontinue criterion is failure on four of five consecutive items. This is a test of spatial imagery.

Quantitative Reasoning - Subject is presented numerical problems of the type A is to Be as C is to ___. There are fifty two such problems with the upper age range starting at item thirty three. There are five teaching items throughout the test. Scoring is 1 or 0 and the test if discontinued

when the subject fails six consecutive items. This test measures numerical reasoning ability utilizing the basic arithmetic procedures of addition, subtraction, multiplication, and division.

Matrices - Subject is presented a matrix of abstract figures with a missing cell and is to select the figure (from among four or six) that will complete the pattern. There are thirty eight items in all with the upper range starting at number twenty-one and having three teaching items. Discontinuation occurs after failure on five of six consecutive items and scoring is 1 or 0. This is a measure of nonverbal reasoning.

Similarities - a verbal reasoning test in which the person is required to say how three things are similar or go together. There are thirty-seven items and the starting point for the upper age range is 18. There are instructions for querying vague responses and scoring is one or zero even if there was a query. There are three teaching items and discontinuation criteria is eight consecutive failures.

The special sub-tests are:

Picture Recognition - Person is shown a picture or a number of pictures for five or ten seconds and is then required to pick these out from a group of pictures. There are twenty-

one items in all and the starting point for the upper age bracket is number six. Two of the items are teaching and the scoring is 1 or 0. The test is discontinued after failure on five of six consecutive items. A test of visual short term memory.

Recall of Objects - Person is shown a card with twenty objects on it for a period of time and is then to recall as many of the objects as possible. This is done for three immediate recall trials. A delayed recall trial occurs fifteen to twenty minutes after the immediate recall - the card not being shown again. Procedure is the same for all ages. The manual does not provide examples of scoring. This is a test of short term and intermediate memory for objects.

Speed of Information Processing - Each item consists of rows of figures, in each row the person puts a line through the largest number. The time taken for each item is recorded as are the number of errors. In the upper age range there are ten items and two practice items. The preliminary manual does not provide a scoring procedure. A motor task requiring simple mental operations. Because there is no formal scoring procedure, this test is not included in the analysis.

Basic Number Skills - Subject is presented a worksheet with various computational problems to solve. There are one hundred and six items of various levels of difficulty. The upper age range commences with item seventy one and the discontinue criteria is reached after six consecutive failures. Scoring is 1 or 0. Measures knowledge of quantitative concepts and arithmetic operation.

Spelling - Subject is to spell words by writing them down on a sheet of paper after the word has been presented orally in isolation, in a sentence, and in isolation again. There are eighty items grouped in blocks of ten. The upper age range starts with item forty-one. Scoring is 1 or 0 and the test is discontinued when the person passes three or fewer items in block of ten. The manual suggests utilizing a basal level of seven items in a block passed and a ceiling level of three items in a block passed. Instructions are provided to facilitate the finding of basal and ceiling level. This test measures spelling ability.

Word Reading - Subject is required to read words from spelling ability card in which words are written in rows of five. There are one hundred and five items with the upper range starting point being item forty-one. Scoring is 1 or 0 depending on whether the word is pronounced correctly or not and the test is discontinued after the person has failed

eight items in two consecutive rows. It is a test of word recognition ability.

For each of the above sub-tests, the manual provides information as to when to administer items outside the range under consideration. Core items are those that are anticipated to be the basis of general Verbal and Nonverbal ability scores upon publication of the DAS, while the special subtests provide information about special abilities. (Psychological Corporation, 1986).

Due to anticipated difficulty of scoring Recall of Digits was not administered. As the DAS manual does not provide instructions for the scoring of Recall of Designs, nor Recall of Objects, they were scored according to criteria presented under procedure. Modification to facilitate data analysis were made to the scoring of Pattern Construction and Spelling. These will also be described under procedure.

PROCEDURE

Patients who had received or were to receive the WAIS-R as a part of their routine psychological assessment were asked if they would be willing to take a further psychological test as a part of a research project being conducted by the author with the approval of the Alberta Hospital Edmonton Research Committee. If they agreed to do so, they were required to give informed consent and sign the

form provided by the Alberta Hospital Edmonton research committee (see Appendix I). Because many patients are threatened by tests of cognitive ability, did not like the extra time involved, and did not like to take the test a second time a month later, only about one out of every twenty patients approached was willing to take part in the study. The resultant sample, therefore, is small and not completely random.

Subjects who volunteered to take part in the study were administered the complete WAIS-R, Ravens Standard Matrices, Mill Hill Vocabulary, and DAS (sub-tests mentioned above) and approximately 30 days later were re-administered the WAIS-R and DAS. Eleven of the subjects received the WAIS-R first, while ten received the DAS first on both occasions. Raven's Matrices and Mill Hill Vocabulary when they were administered were given between the two other tests. As a result of the thirty day period between administrations eight of the patients were outpatients on the second administration while none had a significant change in medication. Both administrations of the DAS, the administration of the Raven's Matrices and the Mill Hill Vocabulary Scale, all second WAIS-R administrations, and eleven of the WAIS-R first administrations were done by the author, while the other ten WAIS-R administrations were done by members of the Alberta Hospital Edmonton psychology department who are trained to administer the WAIS-R. While

breaks were necessarily required due to the length of the assessment, all assessments were done in the same twenty-four hour period. Table 2 provides the actual dates assessed, the order of presentation, and the patient status (inpatient or outpatient) for each patient on second assessment.

TABLE 2

Dates of Assessment, Order of Presentation, and Admission Status for Each Patient

Patient No.	Date of 1st assessment	Date of 2nd assessment	Status on 2nd assessment	Presentation Order
1	27/09/88	27/10/88	Inpatient	WAIS-R first
2	30/09/88	31/10/88	Outpatient	DAS first
3	14/10/88	14/11/88	Inpatient	WAIS-R first
4	16/11/88	15/12/88	Inpatient	DAS first
5	18/11/88	17/12/88	Inpatient	WAIS-R first
6	21/11/88	21/12/88	Outpatient	WAIS-R first
7	28/11/88	29/12/88	Outpatient	DAS first
8	01/02/89	02/03/89	Inpatient	WAIS-R first
9	10/02/89	12/03/89	Inpatient	DAS first
10	14/02/89	14/03/89	Inpatient	DAS first
11	15/02/89	15/03/89	Outpatient	WAIS-R first
12	21/02/89	21/03/89	Inpatient	WAIS-R first
13	23/02/89	23/03/89	Inpatient	DAS first
14	06/03/89	07/04/89	Outpatient	WAIS-R first
15	09/03/89	09/04/89	Inpatient	DAS first
16	16/03/89	16/04/89	Inpatient	WAIS-R first
17	12/06/89	12/07/89	Outpatient	DAS first
18	14/06/89	14/07/89	Inpatient	WAIS-R first
19	21/06/89	21/07/89	Inpatient	DAS first
20	28/06/89	28/07/89	Outpatient	DAS first
21	19/07/89	20/08/89	Outpatient	WAIS-R first

Administration and scoring of the WAIS-R, Ravens Matrices, and Mill-Hill Vocabulary scales followed the standardized procedure in the respective manuals. Administration of the DAS followed the procedure in the norming manual with a fifteen minutes break always occurring between Similarities and Picture Recognition. Order of DAS subtest presentation was always: Recall of Designs, Word Definitions, Pattern Construction, Recall of Objects - Immediate, Quantitative Reasoning, Matrices, Recall of Objects - Delayed, Similarities, Basic Number Skills, Picture Recognition, Speed of Information Processing, Spelling, Word Reading. As the DAS manual does not provide scoring procedures for Recall of Designs, or Recall of Objects, the following procedures were improvised. Recall of Designs was scored 1 if the design was perfectly correct, 0 otherwise, total score was out of 25. Recall of Objects score was the sum of the score obtained on each of the three immediate administrations plus the delayed administration, total score was out of 80. In addition, the score reported for Pattern Construction was the score for correct solutions within the time limit not also the score over time. To make analysis easier, Spelling total raw score was used rather than basal and ceiling age, sex. Finally, except for WAIS-R's administered by persons other than the writer, the time to complete each test was recorded, as well as the time for each DAS sub-test and the total time for each session.

DATA ANALYSIS:

The question of whether the DAS has concurrent validity with the WAIS-R, Mill-Hill and Raven's matrices can be phrased more specifically by asking what is the relationship between the DAS and the WAIS-R, Mill Hill, and Ravens matrices? Pearson Product Moment correlations were computed and correlational matrices for time 1 with time 1 and time 2 with time 2 were generated. The first matrix included the 11 WAIS-R sub-tests, WAIS-R Verbal, Performance, and Full, the Ravens, the Mill-Hill, the 12 DAS sub-tests, DAS core sub-test score (Recall of Designs, Word Definitions, Pattern Construction, Quantitative Reasoning, Matrices, and Similarities), DAS reasoning score (matrices, similarities, and quantitative reasoning), DAS short term memory score (Picture Recognition, Recall of Objects, and Recall of Designs), DAS Retrieval and Application of Knowledge score (Word Definitions, Basic Number Skills, Spelling, Word Reading) and DAS total score. The Raven's and the Mill-Hill were not included in the matrix for time 2 with time 2. The level of significance was set at 0.01.

In order to answer the question what is the relationship between DAS scores when the test is readministered after a period of thirty days Pearson Product Moment correlations will be computed and a correlational matrix generated. This matrix compared testing time 1 with testing time 2 and used the same headings as time 2 with

time 2. Once again, the level of significance was 0.01.

The question does previous experience with the test produce an improvement in performance on repeated administrations can be stated more specifically to read do the mean scores on the tests increase from administration 1 to administration 2. This was answered by utilizing T test for repeated measures on all tests that were administered twice. The level of significance was 0.01.

Finally, the question as to whether there are administrative or other aspects of the DAS that assessed its suitability for use in a psychiatric setting was answered by an analysis of times taken to do the various tests as well as a critique done by the author.

CHAPTER IV

RESULTS

In this chapter the results of the study in terms of relevant descriptive statistics are presented. These results will be related to the four questions the study was designed to answer.

Question #1: Does the DAS have concurrent validity with the WAIS-R, Mill Hill Vocabulary, and Raven's matrices? What is the relationship of the DAS with the WAIS-R, Mill Hill vocabulary, and Raven's matrices? The numbers above the dash in Table 3 are the Pearson-Product moment correlations for time 1 with 1 and includes the 11 WAIS-R sub-tests, WAIS-R Verbal, Performance, and Full, the Raven's, the Mill Hill, 12 DAS sub-tests, DAS core score, DAS Reasoning, DAS Short Term Memory, DAS Retrieval and Application of Knowledge, and DAS Full score. It can be seen that all of the correlations in this table are in a positive direction and range from 0.08 to 0.98. Each correlation in this table was tested for significance by means of the Fisher r to z transformation (Ferguson, 1989, p 168). It should be noted that where degrees of freedom is small, as in this study, a fairly high correlation is required for significance. Degrees of freedom of 20 requires and correlation of 0.54

TABLE 3
Test Retest Reliability Coefficients and Validity Coefficients for First and Second Testing

	RELIABIL-ITIES	WAIS-R INF	DSPN	VOC	ARITH	COMP	SIM	PC	PA	BD	OA	DSYM	VIQ	PIQ	FSIQ	RAVENS	MILLH
WAIS-R																	
INF	.94	-	.71	.85	.72	.68	.74	.30	.67	.30	.32	.21	.85	.60	.80	.45	.85
DSPN	.89	.75	-	.72	.53	.69	.63	.48	.70	.44	.35	.45	.84	.68	.82	.51	.81
VOC	.97	.80	.79	-	.76	.79	.39	.75	.75	.31	.17	.36	.87	.59	.80	.50	.88
ARITH	.94	.72	.69	.82	-	.64	.73	.47	.79	.62	.33	.40	.73	.67	.75	.59	.72
COMP	.94	.66	.72	.81	.70	-	.81	.43	.67	.36	.13	.49	.87	.66	.82	.49	.79
SIM	.89	.61	.67	.77	.64	.79	-	.54	.77	.63	.40	.42	.81	.74	.82	.65	.75
PC	.69	.40	.51	.59	.57	.43	.59	-	.64	.75	.56	.61	.44	.62	.52	.83	.37
PA	.97	.54	.71	.75	.78	.69	.76	.76	-	.60	.45	.53	.76	.82	.82	.73	.76
BD	.93	.41	.45	.57	.73	.42	.65	.66	.76	-	.69	.66	.42	.75	.57	.76	.41
OA	.90	.28	.28	.26	.40	.11	.30	.73	.55	.67	-	.60	.25	.63	.41	.75	.33
DSYM	.91	.29	.51	.62	.55	.52	.52	.52.	.67	.74	.66	-	.36	.66	.49	.65	.46
VIQ	.97	.85	.90	.89	.83	.86	.79	.47	.74	.55	.20	.48	-	.77	.96	.49	.88
PIQ	.94	.56	.66	.66	.77	.55	.60	.73	.86	.82	.70	.74	.70	-	.91	.68	.71
FSIQ	.98	.78	.86	.84	.87	.78	.75	.62	.84	.69	.42	.63	.95	.89	-	.58	.85
RAVENS																-	.54
MILLH																	-
DAS																	
REC	.91	.52	.67	.59	.65	.51	.64	.69	.68	.77	.65	.60	.61	.70	.67		
WD	.94	.71	.78	.86	.72	.91	.72	.41	.70	.49	.16	.50	.87	.63	.81		
PAT	.94	.30	.52	.52	.63	.48	.68	.63	.79	.81	.57	.65	.51	.67	.60		
QUAN	.95	.59	.69	.82	.72	.64	.75	.75	.80	.73	.56	.80	.69	.73	.74		
MAT	.96	.54	.72	.65	.71	.64	.79	.66	.80	.76	.59	.61	.72	.74	.77		
SIM	.94	.72	.75	.90	.76	.81	.85	.53	.76	.64	.33	.60	.83	.63	.78		
PR	.85	.80	.78	.75	.63	.63	.70	.42	.65	.54	.36	.46	.79	.65	.77		
ROI	.95	.25	.29	.50	.34	.40	.56	.34	.51	.50	.35	.60	.30	.41	.33		
ROD	.87	.13	.24	.42	.29	.34	.51	.27	.49	.53	.30	.57	.26	.45	.32		
NUM	.95	.67	.72	.68	.68	.64	.61	.65	.71	.69	.64	.58	.72	.76	.78		
SPL	.91	.68	.64	.55	.33	.39	.26	.29	.21	.12	.19	.36	.56	.35	.52		
WDRD	.94	.71	.83	.75	.57	.60	.49	.32	.51	.40	.18	.48	.74	.49	.67		
REAS	.94	.68	.79	.88	.81	.77	.88	.70	.87	.77	.53	.74	.82	.76	.84		
STM	.96	.42	.50	.63	.50	.52	.68	.48	.65	.66	.47	.66	.50	.60	.53		
VERB	.94	.82	.87	.83	.66	.73	.59	.48	.61	.48	.33	.56	.84	.64	.80		
TOT	.94	.74	.83	.87	.74	.76	.78	.62	.78	.70	.48	.71	.83	.75	.83		
CORE	.93	.69	.81	.88	.82	.82	.86	.68	.87	.78	.50	.72	.85	.78	.86		

N = 21 $p < .01 = .54$

TABLE 3: continued
Reliability and Validity Coefficients

	DAS															
	REC	WD	PAT	QUAN	MAT	SIM	PR	ROI	ROD	NUM	SPL	WDR	REAS	STM	VERB	TOT	CORE
WAIS-R																	
INF	.54	.73	.34	.63	.55	.69	.52	.27	.09	.69	.58	.69	.71	.37	.75	.71	.73
DSPN	.62	.78	.55	.46	.61	.74	.74	.29	.19	.64	.66	.78	.70	.45	.81	.77	.77
VOC	.55	.82	.44	.79	.59	.76	.65	.46	.24	.67	.66	.79	.82	.53	.84	.83	.82
ARITH	.53	.59	.59	.72	.62	.66	.34	.32	.19	.61	.27	.48	.76	.38	.53	.62	.74
COMP	.52	.82	.46	.61	.60	.73	.68	.35	.30	.56	.59	.62	.74	.48	.73	.74	.78
SIM	.64	.71	.65	.66	.76	.81	.55	.47	.40	.60	.31	.47	.85	.57	.57	.73	.85
PC	.70	.32	.89	.60	.84	.45	.35	.24	.32	.61	.34	.39	.68	.41	.46	.59	.69
PA	.66	.76	.73	.75	.78	.78	.57	.45	.42	.78	.39	.61	.88	.57	.70	.80	.89
BD	.64	.29	.85	.48	.72	.53	.32	.40	.55	.08	.27	.64	.64	.46	.31	.53	.64
OA	.58	.11	.66	.35	.63	.39	.18	.15	.17	.64	.14	.18	.51	.27	.29	.41	.48
DSYM	.65	.35	.71	.57	.63	.52	.53	.44	.38	.57	.49	.51	.64	.55	.55	.66	.64
VIQ	.51	.80	.48	.60	.62	.72	.63	.22	.10	.66	.58	.68	.74	.35	.76	.72	.77
PIQ	.63	.62	.71	.61	.79	.62	.59	.28	.29	.82	.37	.53	.75	.45	.64	.70	.78
FSIQ	.57	.76	.58	.63	.71	.70	.64	.24	.17	.75	.52	.65	.77	.39	.75	.74	.80
RAVENS	.75	.40	.84	.72	.85	.68	.42	.35	.46	.73	.31	.44	.84	.52	.52	.70	.80
MILLH	.61	.87	.47	.68	.62	.85	.73	.41	.23	.79	.68	.83	.83	.52	.89	.86	.85
DAS																	
REC	-	.50	.84	.67	.84	.64	.69	.56	.55	.69	.56	.64	.80	.75	.68	.83	.84
WD	.50	-	.38	.58	.55	.80	.75	.48	.39	.68	.61	.77	.75	.57	.86	.83	.82
PAT	.83	.44	-	.59	.87	.60	.50	.49	.51	.62	.30	.40	.76	.64	.47	.69	.78
QUAN	.83	.60	.73	-	.76	.63	.51	.45	.36	.72	.53	.70	.88	.55	.71	.80	.83
MAT	.87	.59	.87	.81	-	.64	.57	.41	.42	.79	.37	.52	.88	.59	.61	.78	.88
SIM	.58	.87	.63	[illegible]	.70	-	.71	.66	.54	.64	.50	.67	.89	.73	.72	.86	.89
PR	.61	.78	.56	.60	.67	.83	-	.68	.61	.60	.74	.78	.69	.81	.82	.87	.76
ROI	.48	.50	.59	.55	.48	.66	.61	-	.84	.32	.36	.42	.59	.95	.44	.70	.61
ROD	.41	.47	.60	.46	.45	.60	.58	.95	-	.28	.16	.29	.51	.89	.31	.58	.54
NUM	.75	.69	.61	.70	.76	.65	.66	.34	.26	-	.57	.71	.80	.48	.82	.81	.82
SPL	.43	.49	.13	.43	.27	.42	.66	.24	.12	.52	-	.87	.53	.47	.89	.75	.59
WDRD	.56	.77	.36	.59	.48	.73	.80	.40	.34	.63	.74	-	.72	.56	.95	.86	.76
REAS	.82	.76	.81	.93	.90	.90	.77	.63	.56	.77	.42	.67	-	.72	.78	.92	.98
STM	.69	.62	.74	.70	.68	.76	.76	.95	.91	.53	.38	.56	.78	-	.58	.82	.75
VERB	.65	.85	.44	.67	.60	.77	.85	.43	.34	.82	.82	.92	.76	.60	-	.92	.83
TOT	.80	.84	.72	.84	.80	.89	.89	.69	.62	.82	.64	.83	.93	.85	.91	-	.96
CORE	.84	.83	.81	.90	.90	.91	.80	.63	.57	.80	.44	.71	.99	.80	.80	.96	-

N = 21 p < .01 = .54

TABLE 3 - continued

CODE FOR TABLE 3

WAIS-R	-	Wechsler Adult Intelligence Scale - Revised
Inf	=	WAIS-R Information
DSpn	=	WAIS-R Digit Span
Voc	=	WAIS-R Vocabulary
Arith	=	WAIS-R Arithmetic
Comp	=	WAIS-R Comprehension
Sim	=	WAIS-R Similarities
PC	=	WAIS-R Picture Completion
PA	=	WAIS-R Picture Arrangement
BD	=	WAIS-R Block Design
OA	=	WAIS-R Object Assembly
DSym	=	WAIS-R Digit Symbol
VS	=	WAIS-R Verbal Score
PS	=	WAIS-R Performance Score
FS	=	WAIS-R Full Score
Ravens	=	Raven's Progressive Matrices
Mill H	=	Mill Hill Vocabulary
DAS	=	Differential Ability Scales
Rec	=	DAS Recall of Designs
Wd	=	DAS Word Definitions
Pat	=	DAS Pattern Construction
Quan	=	DAS Quantitative Reasoning
Mat	=	DAS Matrices
Sim	=	DAS Similarities
PR	=	DAS Picture Recognition
ROI	=	DAS Recall of Objects - Immediate
ROD	=	DAS Recall of Objects - Delayed
Num	=	DAS Basic Number Skills
Spl	=	DAS Spelling
WdRd	=	DAS Word Reading
Reas	=	DAS Reasoning
STM	=	DAS Short Term Memory
Verb	=	DAS Retrieval and Application of Knowledge
Tot	=	DAS Total score
Core	=	DAS Core sub-test score

to be significant at the .01 level. So "little importance can be attached to correlation coefficients calculated on small samples unless these coefficients are fairly substantial in size" (Ferguson, 1989, p 170). In the important cases of DAS total with WAIS-R Verbal, Performance, Full, Ravens, and Mill-Hill Vocabulary scale as well as DAS core with WAIS-R Verbal, Performance, Full, Raven's and Mill-Hill Vocabulary scale the correlations are high and significant at the 0.01 level. Non-significant correlations were obtained for the important cases of DAS STM with WAIS-R Verbal, Performance, Full, Raven's Matrices and Mill-Hill Vocabulary. The size and significance of the correlations presented in this table indicate that the DAS does have concurrent validity with the WAIS-R, Ravens, and Mill-Hill Vocabulary scale in a psychiatric setting.

The numbers below the dash in Table 3 are correlations for time 2 with time 2. The headings are the same except the Mill Hill Vocabulary and Raven's Matrices are not included in the analysis as they were not administered a second time. The correlations in this table are also in a positive direction and range from 0.11 to 0.99. Once again significance was tested for by Fisher r to z transformation. Significant correlations were obtained in the important cases of DAS total with WAIS-R Verbal, Performance, Full as well DAS core with WAIS-R Verbal, Performance, and Full. The size and significance of the correlations presented in

this appendix confirm the presence of concurrent validity of the DAS with the WAIS-R in this setting.

Question #2: What is the relationship between DAS scores when the test is readministered over a period of 30 days? Column one of Table 3 presents the Pearson Product Moment correlations for testing time 1 with testing time 2 and includes the 11 WAIS-R subtests, WAIS-R Verbal, Performance, and Full, 12 DAS sub-tests, DAS core score, DAS reasoning, DAS short term memory, DAS retrieval and applications of knowledge, and DAS Full score. The correlations in this table are in a positive direction and range from 0.69 to 0.97. As above, significance was tested for by utilizing Fisher r to z transformation. In the important cases of WAIS-R Verbal, Performance, and Full and DAS Reasoning, Short Term Memory, Verbal, Core, and Total as well as the individual sub-tests of the DAS and WAIS-R. The exception being the Picture Completion sub-test of the WAIS-R. Twenty-six of these 31 correlations are greater than 0.90 correlations are high and significant at the 0.01 level. The size and significance of the correlations presented in this table indicate that the DAS has test-retest reliability over 30 days in this population.

Question #3: Does experience with the test produce an improvement in performance on repeated administrations? Do

the mean scores on the tests improve from administration to administration? Means of all tests that were administered twice were subjected to T-tests results are presented in Table 4.

The level of significance was 0.01. It can be seen that significant increases in mean for correlated samples IQ's of 10.10 for Verbal WAIS-R, 11.71 for Performance WAIS-R, 21.81 for Full WAIS-R were obtained. DAS Full scores improved a significant 14.36 points over the thirty days. Perusal of the table indicates that 10 of the 23 of the sub-tests making up the full tests showed a significant increase in mean score over the thirty days. It can be concluded that experience with the test does produce an improvement in score over thirty days or the mental health of the subjects improved during that time span.

Question #4: Are there other aspects of the DAS that assess its suitability for use in a psychiatric setting?

One consideration is the time taken to administer the test.

TABLE 4

T-Test Analysis of Difference In Means

Between First and Second Testing

		Difference Mean	S.D.	T value
WAIS-R	Information	1.43	1.36	4.80
WAIS-R	Digit Span	0.76	2.39	1.46
WAIS-R	Vocabulary	3.76	4.21	4.10
WAIS-R	Arithmetic	0.33	1.56	0.98
WAIS-R	Comprehension	1.57	2.75	2.62
WAIS-R	Similarities	2.23	3.51	2.93
WAIS-R	Picture Completion	0.19	3.35	0.26
WAIS-R	Picture Arrangement	0.00	0.00	0.00
WAIS-R	Block Design	2.90	4.59	2.90
WAIS-R	Object Assembly	2.29	3.00	3.49
WAIS-R	Digit Symbol	5.38	6.52	3.60
WAIS-R	Verbal	10.10	9.04	5.12
WAIS-R	Performance	11.71	11.96	3.59
WAIS-R	Full	21.81	20.53	4.48
DAS	Recall of Designs	0.81	2.23	1.67
DAS	Word Definitions	1.10	1.79	2.81
DAS	Pattern Construction	0.38	1.07	1.63
DAS	Quantitative Reasoning	0.86	2.90	1.35
DAS	Matrices	0.52	1.97	1.22
DAS	Similarities	0.95	2.17	2.02
DAS	Picture Recognition	0.95	2.09	0.21
DAS	Recall of Objects (Immediate)	3.52	3.89	4.13
DAS	Recall of Objects (Delayed)	2.14	2.63	3.73
DAS	Basic Number Skills	1.29	3.48	1.69
DAS	Spelling	2.52	5.90	1.96
DAS	Word Reading	0.76	2.97	1.18
DAS	Reasoning	2.33	3.14	3.41
DAS	Short Term Memory	6.38	7.08	4.13
DAS	Retrieval and Application of Knowledge	5.67	8.27	3.14
DAS	Core Sub-tests	4.52	6.39	5.29
DAS	Total	14.76	13.16	5.14

$t < .01$ with 20 df and 1 tailed test = 2.53

Raw scores were used for this analysis.

Table 5 presents the times taken to administer the WAIS-R and the DAS where these were available. The results of this table were not subjected to statistical analysis. It can be seen that the times taken to administer the WAIS-R range from a low of 55 minutes to a high of 75 minutes with a mean administration time of 65.8 minutes. DAS administration times range from a low of 87 minutes to a high of 162 minutes with a mean administration time of 128.3 minutes. Thus it can be seen that the administration time of the DAS is approximately double that of the WAIS-R and the longest WAIS-R administration was shorter than the shortest DAS administration. The administration of the DAS core items, however, is comparable time wise to the administration of the WAIS-R. Other aspects of this question will be considered in the critique under discussion in chapter 5.

TABLE 5

Times for Testing (Minutes)

	1st Testing			2nd Testing		
Subject	WAIS-R	DAS	DAS core	WAIS-R	DAS	DAS core
1	NA	116	65	65	116	55
2	67	124	83	70	122	72
3	NA	120	62	58	131	58
4	57	140	69	55	135	71
5	63	119	53	58	134	64
6	NA	110	60	71	105	56
7	NA	124	61	63	135	67
8	NA	139	85	70	134	71
9	NA	118	63	67	128	64
10	64	110	64	70	140	65
11	NA	137	70	63	134	70
12	NA	107	59	67	111	53
13	NA	113	66	70	87	57
14	NA	128	82	67	157	70
15	NA	107	59	NA	106	56
16	NA	140	72	NA	124	72
17	NA	139	71	68	159	71
18	NA	162	66	78	151	80
19	NA	141	74	NA	146	77
20	68	138	70	69	139	73
21	NA	138	63	65	132	63
	$\bar{X}$ = 63.8	$\bar{X}$ = 127.1		$\bar{X}$ = 66.3	$\bar{X}$ = 129.5	$\bar{X}$ = 65.9

NA = Not Available

WAIS-R mean for both administrations = 65.8 min.
DAS mean for both administrations = 128.3 min.
DAS core mean for both administrations = 66.7 min.

CHAPTER V

DISCUSSION AND IMPLICATIONS

DISCUSSION

The section is a discussion of the results of the study in terms of a results summary, comments on the high scores and low scores with possible reason for negative results. Each of the four questions - the relationship of the DAS to the WAIS-R, Mill-Hill, and Raven's Matrices, the relationship of the DAS scores over a 30 day test-retest period, the issue of whether experience with the test produces an improvement in scores over a 30 day period, and are there other aspects of the DAS that will influence the decision to use it in a psychiatric population - will be dealt with in this manner.

With regard to the concurrent validity of the DAS with the WAIS-R, Mill-Hill, and Raven's Matrices results are encouraging. Statistically significant and acceptable correlations were obtained on most of the important measures. Correlations ranging from 0.74 to 0.86 were obtained when the DAS total score was compared with the WAIS-R Full score, the Ravens, and the Mill-Hill. The highest correlation was with the Mill-Hill. The overall findings tend to confirm the concurrent validity of the DAS. Of interest is the fact that the DAS core measures provide generally higher correlations with the WAIS-R Verbal score, Performance score, and Full score, than does the DAS total

score. This finding has the theoretical merit of tending to confirm the utility of the core subtests as the basis of general Verbal and Nonverbal ability scores and the practical import of meaning that the core sub-tests, which take less time to administer, are at least a valid a substitute for the other tests as is the DAS total. When one looks at sub-tests that are intuitively similar, the correlations are also reasonably high. These include: the DAS vocabulary, WAIS-R vocabulary and Mill-Hill vocabulary which are in the .88 range, the DAS similarities with the WAIS-R similarities, DAS Pattern Construction with WAIS-R Block Design, DAS Matrices with Raven's Matrices all tend to confirm the validity of these sub-tests. Correlations that were not so high were obtained when WAIS-R Arithmetic was compared to DAS Basic Number Skills and DAS Quantitative Reasoning perhaps because the DAS sub-tests are less directly comparable to the WAIS-R arithmetic. While all three use numbers the Quantitative Reasoning is more complex in that the basic concept must be understood and then applied to a new concept, while the Arithmetic and Basic Number skills differ in that the latter enables one to use a pencil to solve the problem and is more comprehensive in the range of skills it taps.

Observation of the test-retest data in the 21 cases where the tests and or sub-tests are compared with themselves indicates that these tests do have good

reliability. Stability of DAS scores is the equivalent of those of the WAIS-R. WAIS-R correlation coefficients are generally higher than those reported on page 32 of the WAIS-R manual. The exception to this was the relatively low relationship of 0.69 on Picture Completion. While this result is still significant it is lower than the others and is difficult to explain but is most likely to be a random artifact of the sample size. It is also possible that the difference is not statistically significant. There was an increase in the total scores over the thirty day period that tends to suggest the subjects remembered the previous testing and benefitted from a practice effect. Another possible explanation of this increase is the subject became healthier due to treatment and thus had an improvement in cognitive function. A combination of the above factors is also possible. The WAIS-R manual reports that for a normal population test-retest means improve by 3 points for Verbal IQ, 9 points for Performance IQ, and 7 points for Full IQ at ages 24-34 and by 3, 8, and 6 points respectively for the age group 35-54 and so the results reported here are consistent.

Other factors that make the DAS suitable or unsuitable use in a psychiatric setting include the time taken to administer the test. If the total test is in administered as it was for this study the time will usually be slightly over two hours but occasionally will take closer to three

hours. This is obviously too long when one considers that the alternative, the WAIS-R takes about one hour. The core measures on the DAS, the measures of general intelligence, however, take about the same time as the WAIS-R and correlate 0.80 with the WAIS-R in the present study and so it would seem reasonable that they could be used as a substitute. Some of the specific sub-tests have potential for use in this population. Many of the patients in the study and psychiatric patients in general are school drop-outs in need of remedial education. Assessment of such abilities as Basic Number Skills, Spelling, and Word Reading could certainly be of benefit in this regard. Memory deficits are also present in psychiatric patients and the group of tests Short Term Memory might be used for this - perhaps if validated against the Wechsler Memory Scale. Generally, the DAS provides a variety of tasks that are challenging for psychiatric patients. The patients in this study generally reported that they enjoyed doing the test.

IMPLICATIONS

Clinical Practice

The results of this research are of no real immediate value for clinical practice as more work on the test needs to be done before one can administer the DAS with a psychiatric population. The potential is clearly there and the need for intelligence testing with this population has

been already discussed. While the DAS itself takes a long time to administer, the DAS core items provide a reasonably valid measure of general intelligence in approximately the same time that is required to administer the WAIS-R. The selection of the DAS core items together with certain of the special tests would appear to be a reasonable alternative to the WAIS-R. For example, problems in arithmetic computation, spelling, or word recognition could be focused on. As Childs (1984) points out in his critique of the BAS intelligence tests should not only establish the intelligence of the individual but also strengths and weaknesses so that remedial action can be undertaken. It has already been noted in chapter one that Matarazzo feels that strength or potential is what should be assessed. Childs further states that the BAS has greater breadth and flexibility than other available instruments. While the BAS is aimed at a school age population, the rules should not be changed for an adult psychiatric population. The DAS has similar breadth and flexibility to the BAS and, in some ways, the scales are more aimed at potential remediation than the WAIS-R (Quantitative Reasoning, Basic Number Skills, Spelling, Word Reading, for example). Its breadth and flexibility are at least as great as that of the WAIS-R. So, the practical implications of this study are to have provided one in a series of necessary steps that will give the clinician a useful alternative to the traditional WAIS-R

when there is a need to assess the intellectual functioning of an adult psychiatrically disturbed patient. This alternative (the DAS) seems to be a potentially reliable and valid instrument that has utility for this population.

Future Research

A lot of work could still be done to find out whether this test could be used with an adult psychiatric population. The first thing relates to the internal validity of the present study and the 30 days test-retest time period. It is possible that this time interval is too short and the high reliability coefficients produced are spurious. One study that could be attempted (although practical considerations would make it very difficult) would be to test re-test with the DAS over different time periods (60 days, 90 days, or even longer) to get a better evaluation of the stability of scores. The internal validity is also affected by the small sample size and the multiple analysis done as the possibility of type I error is increased. Setting the significance level at 0.01 was one way of compensating for this. A third problem with the present study relates to its external validity - the small sample size and the method of selection of subjects, which was necessarily not random makes generalization to a psychiatric population rather tenuous. Repeating the present study with a larger sample size and a random sample

of psychiatric patients (virtually impossible to attain in practice) would improve both internal and external validity. The internal validity would improve as type I error would be reduced and it would also be appropriate to use multivariate techniques and corrections with a larger sample size. The external validity would improve as it is more appropriate to generalize with a larger randomly drawn sample. It should also be noted that the mean IQ on initial testing of this sample was approximately one standard deviation below the general population mean of 100. As a consequence, the results of this study could not be applied to a general adult population. A study to determine the utility of the test with adults in general may be useful.

With regard to further work on the test in this population some other suggestions follow. Obviously, the test needs norms in order to be utilized in the psychiatric setting, the present study used raw score correlations. The scoring of certain sub-tests needs to be developed, standardized, and specified in the manual. Recall of Designs has no scoring procedure in the manual - the present researcher devised his own scoring procedure for the purposes of this study which had the virtue of being consistent. It is probable that a 1 or 0 scoring procedure is not desirable for this sub-test. Another sub-test in which scoring was improvised was the Recall of Objects - Immediate and Delayed and thus development of the scoring of

this sub-test is necessary. The Recall of Digits sub-test and Speed of Information Processing were not included in this study because no scoring is provided and it was anticipated that it would be too difficult to improvise a system. Speed of Information Processing is a timed task that according to the DAS manual appears to cut across all abilities measured. A recent study (Buckhalt & Jensen, 1989 - see chapter II) has indicated that this sub-test has convergent discriminant validity on the BAS. There is no difference between BAS Speed of Information Processing and DAS Speed of Information Processing. To investigate further the validity of this sub-test transformations are needed to convert times to standard scores. One observation that was made in this study was that the DAS short term memory group of sub-tests did not correlate well with the WAIS-R. It may be worthwhile to test the concurrent validity of this sub-test group with a known memory scale such as the Wechsler Memory Scale-Revised.

Finally, further validity and reliability studies could be conducted to further assess these aspects of the test. A factor analytic study, for example, could be conducted to determine the construct validity of the test. Factor analysis could not be done with the small sample size in the present study.

CONCLUSION

The present study has demonstrated that the DAS has potential for use with regards to concurrent validity and test-retest reliability. Although the test is rather long to administer if all sub-tests are given, utilization of the core sub-tests and certain selected special sub-tests require little more time to administer than the complete WAIS-R. The information provided by the DAS can be useful and contributory to a total assessment picture and so it is suggested that further work be conducted on the DAS with an adult psychiatric population.

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APPENDIX 1

APPENDIX I

ALBERTA HOSPITAL EDMONTON CONSENT FORM

PART II: RESEARCH SUBJECT'S SECTION

Alberta Hospital Edmonton
Research Co-ordination
Committee

I, _____, (Research Subject) consent to participate in and authorize the Mental Health Hospital Board, Edmonton. The Alberta Hospital, Edmonton, its staff, physicians and _____ (Researcher) or such other persons as specifically designated by the Research Co-ordination Committee to conduct and perform a research project in which I am a volunteer.

The purpose, aims and goals of the research project have been explained to me and I understand that it involves: (Describe research project)

Together with all necessary attendances and procedures, beginning on or about _____ (Date) and lasting for approximately _____ (duration).

_____ (Researcher) offered to answer any questions concerning the research project and I asked the following questioned and received the following answers: (List all questions and answers)

I understand that I am free to withdraw this consent before or during this research project without any effect upon the care that I may receive at the Alberta Hospital, Edmonton.

I understand that all information as a result of my participation in this research project will be kept private and confidential and will not be published, released nor disclosed without my permission EXCEPT so as to reasonably protect my identify from becoming known. I consent to an authorize the use and release of information for academic, scientific, medical or educational purposes and save and hold harmless the Mental Health Hospital Board, Edmonton,

The Alberta Hospital, Edmonton its staff, physicians and _____ (Researcher) or such other persons as specifically designated by the research co-ordination committee for any damage to property or injury or any other claim which I have or may have, arising out of use or release of information, excluding any claim that I have due to their wilful act or negligence.

Signature or Research Subject	Printed Name of Research Subject	Date

I have reviewed and explained to the research subject who indicated that he/she understood the contents of this document and the part I: Researcher's section and affixed his/her signature.

Signature of Independent Witness	Printed Name of Independent Witness	Date

Signature of Researcher	Printed Name of Researcher	Date

Where attending physician is involved: I approve the participation of the research subject and certify that he/she has the capacity to appreciate the nature and consequences of the proposed research project so as to be capable of rendering an informed judgement:

Signature of Attending Physician	Printed Name of Attending Physician	Date

NOTE TO RESEARCHER: Part III must be completed if research is therapeutic or invasive.

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